# STRATEGY FOR RECOVERY

A core area represents the closest approximation of a biologically functioning unit. The combination of core habitat (*i.e.* habitat that could supply all the necessary elements for the long-term security of bull trout including both spawning and rearing as well as foraging, migrating, and overwintering) and a core population (*i.e.* bull trout inhabiting a core habitat) constitutes the basic core area upon which to gauge recovery within a recovery unit. Within a core area, many local populations may exist.

The Recovery Team provided guidance to recovery unit teams to assist in determining the boundaries of core areas. The guidance included the following:

(1.) Spatial scale of core areas are typically represented by 4$^{th}$-field hydrologic unit codes (HUCs), or aggregates of 4$^{th}$-field HUCs, unless evidence of natural isolation (*e.g.*, a natural barrier or presence of a lake supporting adfluvial bull trout) supports designation of a smaller core area.

(2.) Core area boundaries are conservative, *i.e*. the largest areas likely constituting a core area should be designated as a single core area when doubt exists about the extent of bull trout movements and use of habitats. Data collected that indicate a core area should be split would be considered a refinement to the original core area designation in response to new information.

(3.) Core areas do not overlap. That guidance ensured that core areas were identified using a consistent approach.

A group of bull trout that spawns within a particular stream or portion of a stream system constitutes a **local population**. Until site-specific research indicates spatial, temporal, or genetic isolation, a local population will be considered as the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Gene flow among local

opulations may occur (*e.g.*, those within a core population or broader population unit), but is assumed to be infrequent compared to that among individuals within a local population.

In applying the above guidance to the Saint Mary - Belly River Recovery Unit (Table 3), we determined that two core areas support wide-ranging migratory populations of bull trout, the Saint Mary River and the Belly River. In addition, isolated secondary core areas occur in Red Eagle Lake, Slide Lake, and Cracker Lake. They support bull trout that are migratory, but only within confined portions of the isolated lake and stream system where they exist (see explanation and discussion of secondary core areas on page 2). Finally, we determined that United States headwaters of Lee Creek should be also considered a secondary core area, for reasons to be explained in the following paragraphs.

**Table 3.** List of bull trout local populations (in bold) by core area, in the Saint Mary - Belly River Recovery Unit.

| CORE AREA | LOCAL POPULATION |
|---|---|
| Saint Mary River | **Boulder Creek**<br>**Kennedy and Otatso Creek (lower)**<br>***Red Eagle Creek (lower)**<br>***Divide Creek** |
| Lee Creek | ***Lee Creek (forks)** |
| Red Eagle Lake | **Red Eagle Creek (upper)** |
| Cracker Lake | **Canyon Creek** |
| Slide Lake | **Otatso Creek (upper)** |
| Belly River | **North Fork Belly River** |

* Distribution and abundance of local populations of bull trout in watersheds marked by an asterisk is poorly known. Continued surveys may indicate the need for some modifications or exclusions to the list of local populations.

The largest core area, geographically, is the Saint Mary River, with at least two relatively strong existing local populations in Boulder and Kennedy creeks. Lower Otatso Creek is currently considered part of the Kennedy Creek complex, since no spawning has been detected there and the habitat appears marginal to support spawning. Divide Creek and Red Eagle Creek (downstream from Red Eagle Lake) were also considered local populations, but neither stream has recent documentation of spawning activity by Saint Mary River or Saint Mary Lake bull trout. In Divide Creek, evaluation by Mogen and Kaeding (2001) failed to detect spawning activity. However, bull trout continue to occupy the drainage, resulting in our determination that this stream continues to support a local population. In lower Red Eagle Creek there is no recent survey information available, but large migratory bull trout were historically reported to be found there.

Lee Creek is the second core area identified in the Saint Mary drainage and is also thought to support migratory bull trout, perhaps even multiple local populations. However, the connectivity status of migratory fish in Lee Creek to the rest of the Saint Mary system has not been determined. Lee Creek was undoubtedly part of the primary Saint Mary River Core Area historically, particularly when bull trout ranged downstream in the Saint Mary River system prior to the construction of Saint Mary Reservoir. However, Lee Creek now appears largely isolated due to several factors, but primarily due to habitat impacts in lower Lee Creek in Alberta. The United States headwaters of Lee Creek are thought to be reproductively isolated from the United States local populations in Boulder and Kennedy creeks. That is partially why we considered the United States headwaters of Lee Creek to form a separate secondary core area. An additional consideration is that nearly the entire migratory corridor between upper Lee Creek and the United States portions of the Saint Mary River drainage are located in Canada, and therefore not bound by most of the considerations of the Endangered Species Act. The recovery guidance set forth in the Draft Bull Trout Recovery Plan (USFWS 2002) is strictly voluntary in Canada.

The impacts to bull trout connectivity caused by construction of Saint Mary Reservoir are debatable. The reservoir does not contain suitable habitat for bull

tout in the summer months and it eliminates the potential for migratory use of the lower-most portions of the Saint Mary River downstream from the dam. However, bull trout from the Saint Mary River upstream of Saint Mary Reservoir are not impeded from using Lee Creek. Further information on current migratory interchange between Lee Creek and the Saint Mary River, including genetic support, could lead to reconsideration of Lee Creek as a separate core area from the Saint Mary River.

The third core area containing wide-ranging migratory fish is in the Belly River drainage. A single local population is identified in the North Fork Belly River, the only known spawning area for the Belly River Core Area. Most of the foraging, migrating, and overwintering habitat for this core area is in Alberta.

There are also three small lakes which support adfluvial bull trout core areas in their headwaters. These core areas, referred to as secondary core areas (see additional discussion on page 2 and elsewhere in this chapter), are based in smaller watersheds and typically contain adfluvial populations of bull trout that have become naturally isolated, with restricted upstream spawning and rearing habitat. Secondary core areas each include one identified local population of bull trout and are not believed to contain habitat of sufficient size and complexity to accommodate multiple local populations. Secondary core areas have the potential to support a few hundred adult bull trout at most, even in a recovered condition. In most cases these conditions are natural, and it is believed that in some situations bull trout have existed for thousands of years with populations seldom exceeding 100 adult fish.

The distinction between primary and secondary core areas is made, not to infer a different level of importance for recovery purposes, but rather, to indicate that a different set of standards are needed for recovery criteria, in particular for addressing abundance. Secondary core areas may support genetic and phenotypic diversity not found elsewhere in the Saint Mary - Belly River Recovery Unit.

The three secondary core areas are Red Eagle Lake (upper Red Eagle Creek), Slide Lake (upper Otatso Creek), and Cracker Lake (Canyon Creek). Red Eagle Lake may not be isolated by physical barriers (Stevens, *in litt.* 1996), but by bull trout behavior. Red Eagle Lake is similar to lakes in the adjacent Flathead River headwaters of the Columbia River drainage, that were found to be reproductively isolated from migratory bull trout in the Flathead Lake Core Area downstream. Bull trout do not typically migrate from one lake through another lake to spawn upstream. Slide Lake is physically isolated most of the year by existing barriers from the downstream system. In the case of Cracker Lake, historical isolation is uncertain, but the presence of Sherburne Dam physically isolates it from the Saint Mary River system downstream. Because Cracker Lake is believed to be an introduced population from an unknown source, there is some question as to whether it should be considered a core area, but we are including it for the time being.

## Recovery Goals and Objectives

The goal of the bull trout recovery plan is to **ensure the long-term persistence of self-sustaining, complex interacting groups of bull trout distributed throughout the species' native range, so that the species can be delisted**. To achieve this goal the following objectives have been identified for bull trout in the Saint Mary - Belly River Recovery Unit:

- Maintain the current distribution of bull trout and restore distribution in previously occupied areas within the Saint Mary - Belly River Recovery Unit.

- Maintain stable or increasing trends in bull trout abundance.

- Restore and maintain suitable habitat conditions for all life history stages and forms.

- Conserve genetic diversity and provide opportunity for genetic exchange.

- A primary concern is the need for a more formal working relationship between United States and Canadian interests in addressing bull trout restoration in the Saint Mary and Belly River drainages. Because the local bull trout populations in the Saint Mary and Belly river drainages are comprised mostly of migratory fish, and much of their habitat is in Canada, coordination with these jurisdictions is absolutely critical to recovery.

Bull trout are now distributed among at least nine local populations within six core areas of the Saint Mary - Belly River Recovery Unit located wholly or partly in the United States (see Table 3). Though most of the spawning takes place in United States headwaters, much of the rearing and foraging, migrating and overwintering habitat for bull trout in the Saint Mary and Belly river drainages is in Alberta, outside the jurisdiction of the Draft Bull Trout Recovery Plan (USFWS 2002). As more distribution and genetic information is developed throughout the range of bull trout in the Saint Mary - Belly River Recovery Unit, the number of local populations identified may increase.

In the Saint Mary - Belly River Recovery Unit within the United States, the historical distribution of bull trout is believed to be relatively intact. There are no areas where reestablishment of extirpated local populations in the U.S. is recommended, with the possible exception of Divide Creek. In that system, uncertainty exists over its historical status, but the population appears to have declined to precariously low numbers. Throughout the Saint Mary - Belly River Recovery Unit, the emphasis must be placed on securing the existing distribution, increasing the abundance and connectivity of local populations, and coordination with Canadian entities.

It is broadly acknowledged that there are inherent stochastic as well as genetic risks associated with low population levels of any species. However, to date there has been a great deal of uncertainty as to the proper application of theoretical population standards to bull trout. The number of 1,000 annually spawning adults was proposed by Rieman and Allendorf (2001) as a cautious management goal for long-term maintenance of genetic variation in a bull trout

ore area population. Of the six core areas identified in the Saint Mary - Belly River Recovery Unit, it is not believed that any have the potential to support 1,000 or more adult bull trout, particularly in U.S. portions of the drainage. At best, the historically interconnected Saint Mary system, including Lee Creek and downstream portions of the drainage, may have come closest to achieving that level of abundance.

Recovery criteria for the Saint Mary - Belly River Recovery Unit reflect the stated objectives and consideration of population and habitat characteristics within the recovery unit. The Saint Mary - Belly River Recovery Unit Team evaluated the current status of bull trout based on four populations elements. The four elements were: (1) Number of local populations, (2) Adult abundance (defined as the number of sexually mature fish present in a core area in a given year), (3) Productivity (defined as a measure of population trend and variability), and (4) Life history forms (as an indicator of the functional connectivity of the system).

These elements were derived from the best scientific information available concerning bull trout population and habitat requirements (Rieman and McIntyre 1993; Rieman and Allendorf 2001). These guidelines are likely to be revised in the future as more detailed information on bull trout population dynamics becomes available. Given the limited information on bull trout, the level of adult abundance, and number of local populations needed to spread extinction risk should be viewed as a best estimate. Based on the best data available, and professional judgement, the Saint Mary - Belly River Recovery Unit Team then evaluated each element under a potential recovered condition resulting in recovery criteria. Evaluation of these elements under a recovered condition assumed that actions identified within this chapter had been implemented.

**Local Populations**

Metapopulation theory is an important consideration in bull trout recovery. A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994) (See Chapter 1). Multiple local populations distributed and interconnected

hroughout a watershed provide a mechanism for spreading risk from stochastic events. Distribution of local populations in such a manner is, in part, an indicator of a functioning core area. Based in part on guidance from Rieman and McIntyre (1993), bull trout core areas with less than five local populations are at increased risk; core areas with between 5-10 local populations are at intermediate risk; and core areas which have more than 10 interconnected local populations are at diminished risk. Based on this element, all the core areas in the Saint Mary - Belly River Recovery Unit are at increased risk, and will remain so even under recovered conditions.

**Adult Abundance**

The recovered abundance levels in the Saint Mary - Belly River Recovery Unit were evaluated by considering theoretical estimates of effective population size, historic census information, and the professional judgement of recovery team members. In general, effective population size is a theoretical concept that allows one to predict potential future losses of genetic variation within a population, due to small population sizes and genetic drift (See Chapter 1). For the purpose of recovery planning, effective population size is the number of adult bull trout that successfully spawn annually. Based on standardized theoretical equations (Crow and Kimura 1970), guidelines have been established for maintaining minimum effective population sizes for conservation purposes. Effective population sizes greater than 50 adults are necessary to prevent inbreeding depression and a potential decrease in viability or reproductive fitness of a population (Franklin 1980). In order to minimize the loss of genetic variation due to genetic drift, and maintain constant genetic variance within a population, an effective population size of at least 500 is recommended (Franklin 1980; Soule 1980; Lande 1988). Effective population sizes required to maintain long-term genetic variation that can serve as a reservoir for future adaptations in response to natural selection and changing environmental conditions are discussed in Chapter 1 of the recovery plan.

For bull trout, Rieman and Allendorf (2001) estimated that a minimum census number of 50 to 100 spawners per year was needed to minimize potential inbreeding effects within local populations. Furthermore, a census population

sizeetween 500 and 1,000 adults in a core area is needed to minimize the deleterious effects of genetic variation due to drift.

For the purposes of bull trout recovery planning, abundance levels were conservatively evaluated at the local population and core area levels. Local populations which contained less than 100 censussed spawning adults per year were classified at risk from inbreeding depression. Bull trout core areas which contained less that 1,000 censussed spawning adults per year were classified as at risk from genetic drift. In the primary core areas of the Saint Mary and Belly rivers it is unlikely that 1,000 spawning adults can be achieved. For the secondary core areas in the Saint Mary - Belly River Recovery Unit, even a level of 100 censussed spawning adult bull trout may be difficult to attain.

**Productivity**

A stable or increasing population is a key criterion for recovery under the requirements of the Endangered Species Act. Measures of the trend of a population (the tendency to increase, decrease, or remain stable) include population growth rate or productivity. Estimates of population growth rate (*i.e.* productivity over the entire life cycle) that indicate a population is consistently failing to replace itself, indicate increased extinction risk. Therefore, the reproductive rate should indicate the population is replacing itself, or growing.

Since estimates of the total population size are rarely available, the productivity or population growth rate is usually estimated from temporal trends in indices of abundance at a particular life stage. For example, redd counts are often used as an index of a spawning adult population. The direction and magnitude of a trend in the index can be used as a surrogate for the growth rate of the entire population. For instance, a downward trend in an abundance indicator may signal the need for increased protection, regardless of the actual size of the population. A population which is below recovered abundance levels but moving toward recovery would be expected to exhibit an increasing trend in the indicator. The population growth rate is an indicator of extinction probability. The probability of going extinct cannot be measured directly; it can, however, be estimated as the

consequence of the population growth rate and the variability in that rate. For a population to be considered viable, its natural productivity should be sufficient to replace itself from generation to generation. Evaluations of population status will also have to take into account uncertainty in estimates of population growth rate or productivity. The growth rate must indicate a stable or increasing population for a period of time for the population to contribute to recovery.

**Connectivity**

The presence of the migratory life history form within the primary core areas of the Saint Mary and Belly rivers is an indicator of functional connectivity within the recovery unit. Since the migratory life form is present in all local populations, and they have demonstrated connectivity with other local populations, the primary core areas were considered to be at diminished risk. For the secondary core areas, where the migratory form is present but local populations lack connectivity, these four core areas were considered to be at increased risk.

The numerical criteria we propose, to ensure replication of populations and to function as minimum recovery standards for adult bull trout abundance in the Saint Mary - Belly River Recovery Unit, are based in part upon estimates of the minimum population levels required for maintenance of long-term genetic variability (1,000 adults) and genetic viability (100 adults). However, we also utilized the best professional scientific judgment of the recovery unit team members in setting those standards. The proposed recovery standards are based primarily on genetic concerns. Over time, protection of other ecological and biological attributes that contribute to population viability and long-term population stability will need to be considered as well.

Rieman and Allendorf (2001) cautioned that the guidelines they presented represent conservative minimum standards for the conservation of genetic variability and not "goals that will assure the viability of any population". They also noted that mitigation of extinction threats associated with demographic processes may require larger population sizes regardless of the genetic issues. They

conclude that maintenance of genetic diversity is essential, but not necessarily sufficient, for effective conservation.

It must be noted, however, that populations in secondary core areas in the Saint Mary - Belly River Recovery Unit are essentially stranded local populations (*e.g.*, Slide Lake). Some may have persisted for a long time at population levels similar to their current status. Most such populations will continue to exist at a high degree of genetic risk as well as being subject to high risk of extirpation due to stochastic events. As more numerical data are collected and trends are more clearly documented, the abundance standards will be further refined in their application as recovery criteria.

**Recovery Criteria**

Recovery criteria are established to assess whether recovery actions have resulted in the recovery of bull trout. The Recovery Team acknowledges that some local populations, possibly core area populations, may be extirpated even though recovery actions are being implemented. Bull trout populations may be extirpated by stochastic and deterministic factors due to existing threats of habitat degradation and variability, population fragmentation, and other factors influencing populations (*e.g.,* nonnative species introductions). In some instances, extirpations may occur as a result of natural events. If reestablishment of recently extirpated populations is deemed infeasible or impractical, then recovery criteria for a given recovery unit will be revised to reflect the current condition.

Our intent is to maximize the likelihood of persistence of bull trout. This will be achieved, in part, by seeking to perpetuate the current distribution and maintaining or increasing abundance of all local bull trout populations that are currently identified or will be identified in the future in the Saint Mary - Belly River Recovery Unit (Table 3). In recovered condition each core area is expected to maximize the number of local populations and to move as far as possible toward supporting a total level of 1,000 or more adult bull trout in the recovery unit.

Attainment of the recovery criteria, including increased monitoring and evaluation, will require the cooperative efforts of Federal, and Tribal resource management agencies; government and private landowners and water users; conservation organizations; and other interested parties. It is important to note that the United States Endangered Species Act does not apply in Canada. However, due to the transboundary and migratory nature of these bull trout populations, continuing contributions from Canadian waters are critical to maintenance of bull trout in the Saint Mary - Belly River Recovery Unit.

The following recovery criteria will only be achieved through the reduction of threats to bull trout, in part as a result of implementation of tasks identified in the recovery measures narrative of this recovery plan, as well as by pursuing other new conservation and recovery opportunities as they arise. The Saint Mary - Belly River Recovery Unit will be considered recovered (*i.e*. the threat of extinction removed) when the following specific criteria are met.

**1. Distribution criteria will be met when the total number of stable local populations of bull trout in United States waters of the Saint Mary - Belly River Recovery Unit is nine or more, and local populations remain broadly distributed in each core area**.

The distribution criteria must be applied with enough flexibility to allow for adaptive changes in the list of local populations (both additions and subtractions), based on best available science, as the body of knowledge concerning local populations and genetic inventory grows.

The distribution criteria cannot be met if major gaps develop in the current distribution of migratory bull trout in the primary core areas of the Saint Mary - Belly River Recovery Unit within the United States, *i.e*. Saint Mary River, Lee Creek, or the Belly River. Reconnection of fragmented habitat, as well as documentation of new or previously undescribed local populations, may allow the documented distribution of bull trout to increase as recovery progresses. We recognize the risk that stochastic events or deterministic processes already

occurring could cause a loss of distribution in some cases. The significance of such losses in the ultimate determination of whether or not distribution criteria have been met need to be judged on a case-by- case basis. Maintaining the distribution of bull trout in the Alberta portion of these watersheds is equally critical, though not covered under the jurisdiction of the Draft Bull Trout Recovery Plan (USFWS 2002).

**2. Abundance criteria will be met when each of the six core areas in the Saint Mary - Belly River Recovery Unit is documented to support at least one local population with an average of 100 or more adult bull trout annually (in U.S. tributaries). In the interconnected Saint Mary River core area the local populations must support an annual average of 500 or more adult bull trout (Table 4).**

Some of the rearing habitat and much of the foraging, migrating and overwintering habitat associated with these core areas is in Alberta. That makes achieving the recovery criteria somewhat problematic, since the Endangered Species Act does not apply in Canada. However, it is important that each core area be treated as a continuous ecosystem, despite political boundaries. It is not realistic to expect full recovery to occur in the Saint Mary River, Lee Creek, and Belly River core areas, which support internationally migrating bull trout, without strong international cooperation. As more information becomes available, the above criteria for each of these three core areas should be reevaluated and may be adjusted to reflect that new information. We emphasize that these criteria must be adaptive if we are to fully protect and restore bull trout in the Saint Mary - Belly River Recovery Unit.

Distribution and abundance of local populations of bull trout in portions of the Saint Mary River and the Belly River watershed is poorly known. Continued survey may indicate substantial departure from the current list.

**3. Trend criteria will be met when the overall bull trout population in the Saint Mary - Belly River Recovery Unit is accepted, under contemporary standards of the time, as stable or increasing; based on at least 10 years of monitoring data**.

For the three migratory populations inhabiting international core areas, trend analysis will include composite information for the United States and Alberta, Canada. See Monitoring Strategy section for additional clarification.

Table 4. Numeric standards necessary to achieve recovered abundance of bull trout in core areas of the Saint Mary - Belly River Recovery Unit.

| CORE AREA | Existing Number (Estimated) Local Populations (U.S.) | Existing Number (Estimated) Local Populations > 100 Adults (U.S.) | Recovered Minimum Number Local Populations >100 Adults (U.S.) | Recovered Minimum Number Core Area Adult Abundance |
|---|---|---|---|---|
| Saint Mary River | 4 | 2 | 4 | 500 |
| Lee Creek | 1 | 0 | 1 | 100 |
| Red Eagle Lake | 1 | 0 | 1 | 100 |
| Cracker Lake | 1 | 1 | 1 | 100 |
| Slide Lake | 1 | 1 | 1 | 100 |
| Belly River | 1 | 1 | 1 | 100 |

**4. Connectivity criteria will be met when Sherburne Dam and Saint Mary Diversion operational and maintenance issues, including instream flow, fish passage, and entrainment concerns, are satisfactorily addressed (as identified through the U.S. Fish and**

**Wildlife Service Biological Opinion culminating from section 7 consultation with the U.S. Bureau of Reclamation).**

In the Saint Mary - Belly River Recovery Unit substantial gains in reconnecting fragmented habitat within the Saint Mary River Core Area may be achieved by restoring unimpeded passage over Saint Mary Diversion Dam and eliminating entrainment in the Saint Mary Canal. The diversion and associated canal are the single most important connectivity issue in United States waters of this recovery unit, but additional gains in resolving fish passage and entrainment issues in the Mountain View Irrigation District and United Irrigation District downstream in Alberta will be necessary to fully restore the bull trout population in the Saint Mary - Belly River Recovery Unit.

We reemphasize that recovery planning and formal delisting decisions are separate processes. Delisting decisions should be based on information available at the time delisting is proposed, not necessarily on the standards set in Table 4 and the recovery criteria, which are being used to guide recovery in the present.

## Monitoring Strategy

Monitoring of at least four local populations (Table 3) is necessary, including at least two in the Saint Mary River (Boulder and Kennedy creeks) and one each in Lee Creek and the Belly River. These are the strongest remaining migratory populations. The isolated secondary core areas (Red Eagle, Cracker, and Slide lakes) exist in relatively unaltered headwater basins and aside from potential introductions of nonnative fish, face minimal threats. Protection and restoration efforts should continue to be applied to all local populations of bull trout throughout the Saint Mary River and Belly River basins (United States and Canada) to protect important genetic diversity; maintain healthy, viable populations; and secure or improve the existing distribution. The ultimate goal is to meet the criteria and recover bull trout in the Saint Mary - Belly River Recovery Unit to a level that makes them eligible to contribute to delisting as rapidly and efficiently as possible.

The Alberta Bull Trout Task Force (1995) identified long-term monitoring of a coordinated series of a dozen index populations across the Province as a high priority. The North Belly River population was included among those high priority systems recommended for monitoring.

Within the recovery criteria and monitoring strategy there are several terms which have not been previously defined, requiring some elaboration:

**Population monitoring to accepted standards:** Refers to redd counts, juvenile electrofishing estimates, snorkel surveys, net catches, or other distribution and abundance indices that are agreed to by U.S. Fish and Wildlife Service and the management agencies as adequate to establish presence or absence and trend of local bull trout populations. These standards may vary from population to population, but should, at a minimum, meet the established protocols for presence or absence adopted by the Western Division of the American Fisheries Society (Peterson *et al.* 2001).

**Sufficient regularity**: Refers to the frequency with which monitoring must occur. To establish statistically definable trends, annual monitoring will normally be required, as is the case for the interconnected waters in the Saint Mary - Belly Distinct Population Segment. For local populations where threats are minimal and habitat is remote (*e.g.*, National Park headwaters), or where a sufficient baseline already exists, it may eventually be sufficient to monitor every other or even every third year. These decisions should be made on a case-by-case basis.

**Contemporary standards**: Refers to the use of modern analytical tools to evaluate trends in local bull trout population abundance, currently an area of considerable research focus. It is expected that population models and other tools will be developed in the next few years that will improve upon existing methods for identifying and interpreting population response. We recommend that evaluation and interpretation of the direction and

magnitude of population trends should be conducted using the most commonly accepted and scientifically supportable methods available at the time the analysis occurs, and not necessarily upon those currently in use.

With those terms in mind, it is the intention of the recovery unit team that population monitoring to accepted standards occur, with sufficient regularity in at least four of the currently identified local populations (two in the Saint Mary River Core Area, one each in the Lee Creek and Belly River core areas), to verify continued distribution and enable assessment of bull trout population status under contemporary standards. Additional monitoring in portions of the watershed located in Alberta should be supported, to satisfy concerns that all important local populations have been identified and are being evaluated and to meet the abundance criteria for the core areas.

# ACTIONS NEEDED

**Recovery Measures Narrative**

In this chapter and all other chapters of the bull trout recovery plan, the recovery measures narrative consists of a hierarchical listing of actions that follow a standard template. The first-tier entries are identical in all chapters and represent general recovery tasks under which specific (*e.g.*, third-tier) tasks appear when appropriate. Second-tier entries also represent general recovery tasks under which specific tasks appear. For a complete and thorough discussion of second-tier tasks, see Chapter 1. Second-tier tasks that do not include specific third-tier actions are either programmatic activities that are applicable across the species' range and appear in *italicized font* or are tasks that may not be sufficiently developed to apply to the recovery unit at this time and appear in *an italicized shaded font (as seen here)*. These tasks are included to preserve consistency in numbering tasks among recovery unit chapters and intended to assist in generating information during the comment period for the draft recovery plan, a period during which additional tasks may be developed. Third-tier entries are tasks specific to the Saint Mary - Belly River Recovery Unit. They appear in the implementation schedule that follows this section and are identified by three numerals separated by periods.

The Saint Mary - Belly River Recovery Unit chapter should be updated or revised as recovery tasks are accomplished, environmental conditions change, or monitoring results or other new information becomes available. Revisions to the Saint Mary - Belly River Recovery Unit Chapter will likely focus on priority streams or stream segments within core areas where restoration activities occurred, and habitat or bull trout populations have shown a positive response. The Saint Mary - Belly River Recovery Unit Team should meet annually to review annual monitoring reports and summaries, and make recommendations to the U.S. Fish and Wildlife Service.

1 Protect, restore, and maintain suitable habitat conditions for bull trout.

1.1 Maintain or improve water quality in bull trout core areas or potential core habitat.

1.1.1 **Reduce general sediment sources**. Stabilize roads, crossings, and other sources of sediment delivery. Potential sites include Divide Creek, lower Swiftcurrent Creek, and the headwaters (Middle Fork and East Fork) of Lee Creek.

1.1.2 **Implement Divide Creek restoration actions**. Watershed analysis of channel instability in lower Divide Creek, related to Glacier National Park and private developments, was completed in the early 1990's. Recommended solutions to chronic road and sediment delivery problems in and around Saint Mary must be implemented to restore aquatic function.

1.1.3 **Upgrade problem roads**. Upgrade or relocate portions of roads, camping areas and parking lots, especially along lower Divide Creek, lower Swiftcurrent Creek, Wild Creek, and any other identified sites in order to reduce impacts from floodplain encroachment and channel alterations.

1.1.4 **Develop and implement a basin-wide Total Maximum Daily Load program.**

1.1.5 **Support habitat protection and monitoring in Alberta**. Work collaboratively with Alberta Sustainable Resource Development, Parks Canada, and other Canadian governmental and nongovernmental entities to ensure bull trout habitat is protected and enhanced in the Saint Mary and Belly river watersheds.

1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.

1.2.1 **Eliminate entrainment in diversions**. Continue efforts to eliminate loss of fish through entrainment in diversions; in part by continued implementation of screening projects on water intakes on United Irrigation District and Mountain View Irrigation District diversions on the Belly River (Alberta), and by incorporating screens on the Saint Mary Diversion in Montana (evaluation in progress).

1.2.2 **Provide fish passage around diversions**. Install effective fish passage structures around diversions on all bull trout streams and/or remove related migration barriers, specifically including, but not limited to: United Irrigation District and Mountain View Irrigation District diversions on the Belly River (Alberta), and the Saint Mary Diversion in Montana.

1.2.3 **Eliminate culvert barriers**. Monitor road crossings for blockages to upstream passage, and replace any existing culverts or manmade blockages that may impede fish passage as necessary. One site currently identified on Middle Fork Lee Creek is a high priority.

1.2.4 **Improve instream flows**. Restore connectivity, opportunities for migration, and improve habitat by ecuring or improving instream flows. This may be achieved by acquiring water rights from willing sellers, implementing conservation agreements or Habitat Conservation Plans, or other measures. Priority streams identified to date include lower Swiftcurrent Creek, Belly River (Alberta), Saint Mary River (Montana and Alberta), Lee Creek (Alberta).

1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions.

1.3.1 **Conduct watershed problem assessments**. Identify site-specific threats (problem assessment) that may be limiting bull trout in watersheds not already evaluated. Examples include Divide Creek, and Middle and East Forks Lee creek in the Saint Mary drainage.

1.3.2 **Revegetate denuded riparian areas**. Revegetate to restore shade and canopy, riparian cover, and native vegetation in streams where investigation indicates actions are likely to benefit bull trout and other native fish. Priority watersheds include lower Divide Creek and lower Swiftcurrent Creek.

1.3.3 **Improve grazing practices**. Reduce negative effects of grazing with improved grazing management or riparian fencing where investigation indicates actions are likely to benefit bull trout and other native fish. Priority watersheds may include Middle Fork and East Fork Lee Creek, lower Kennedy Creek (inside and outside Glacier National Park), lower Otatso Creek, and portions of Belly River (Alberta).

1.3.4 **Restore stream channels.** Conduct stream channel restoration activities where investigation indicates actions are likely to benefit bull trout and other native fish. Priority watersheds include lower Swiftcurrent Creek and Divide Creek.

1.3.5 **Improve instream habitat**. Increase or improve instream habitat by restoring recruitment of large woody debris, pool development, or using other appropriate means in streams where investigation indicates actions are likely to benefit

bull trout and other native fish. Priority watersheds include lower Swiftcurrent Creek and Divide Creek.

1.3.6 **Minimize potential stream channel degradation**. Ensure that negative effects to bull trout of ongoing flood control activities (*e.g.*, dredging, channel clearing on lower Divide and Swiftcurrent creeks) are minimized or eliminated.

1.4 Operate dams to minimize negative effects on bull trout.

1.4.1 **Optimize outflow patterns from Sherburne Dam**. Continue ongoing discussions and implement a program to integrate reservoir operations with the demands for downstream flow releases in a fashion that restores a more naturally shaped dam discharge pattern (both seasonally and daily), and accommodates sufficient instream flows for threatened bull trout and other native species.

1.4.2 **Establish and restore natural thermal regime**. Attempt to determine natural thermal conditions in lower Swiftcurrent Creek and, to the extent possible, restore those conditions so that the normal biological migratory and growth response of bull trout is enhanced in the creek and the Saint Mary River downstream. Additional thermal concerns occur due to dewatering of the lower Belly and Saint Mary rivers in Alberta.

1.4.3 **Provide flushing flows**. Encourage seasonal peak flows downstream from Sherburne Dam in at least some years, coordinated with irrigation needs, that simulate natural conditions to physically maintain habitat (*i.e*. prevent delta formation which may cause migratory blockages at the mouths of tributaries). Existing problems may occur at mouth of Boulder Creek.

1.5 Identify upland conditions negatively affecting bull trout habitats and implement tasks to restore appropriate functions.

1.5.1 **Monitor and mitigate fire effects, where necessary**. Monitor effects from wildfires and pursue habitat restoration actions if warranted (primarily outside Glacier National Park). Initial evaluation may be needed in Boulder Creek drainage.

2 Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.

2.1 Develop, implement, and evaluate enforcement of public and private fish stocking policies to reduce stocking of nonnative fishes that affect bull trout.

2.1.1 **Update fish hatchery and stocking practices**. Evaluate all fish stocking programs and private and public hatchery practices to minimize the risk of further inadvertent introduction of nonnative species to the Saint Mary River and Belly River drainages.

2.1.2 **Renovate Flattop Lake**. Remove the reproducing population of nonnative Yellowstone cutthroat, established in the 1980's by an experimental program, in order to reduce potential for conflict in the important bull trout habitat of Boulder Creek.

*2.2 Evaluate enforcement of policies for preventing illegal transport and introduction of nonnative fishes.*

2.3 Provide information to the public about ecosystem concerns of illegal introductions of nonnative fishes.

2.3.1 **Discourage unauthorized fish introductions**. Implement an educational effort about the problems and consequences associated with unauthorized fish introductions.

2.3.2 **Develop bull trout education program**. Develop and present public information programs with broad emphasis on bull trout ecology and life history requirements and more specific focus on regionally or locally important recovery issues.

2.4 Evaluate biological, economic, and social effects of control of nonnative fishes.

2.4.1 **Evaluate experimental removal of established brook trout populations**. Evaluate opportunities for removal of brook trout from selected streams and lakes. Priority watersheds include headwaters in Glacier National Park and Belly River system in the United States and Canada.

2.5 Implement control of nonnative fishes where found to be feasible and appropriate.

2.5.1 **Implement nonnative fish control efforts where removal is necessary for bull trout recovery and determined to be feasible.** If research indicates site-specific conflicts with brook trout or other nonnative fish limit recovery opportunity implement control actions (see related tasks 2.4.1, 3.3.1, 3.4.2).

*2.6 Develop tasks to reduce negative effects of nonnative taxa on bull trout.*

3 Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.

3.1 Develop and implement Tribal native fish management plans integrating adaptive research.

3.1.1 **Implement adaptive management**. Adaptively integrate contemporary research results to incorporate best available science into Tribal fishery management program.

3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.

3.2.1 **Minimize unintentional bull trout mortality**. Continue to develop and implement sport angling regulations and fisheries management plans, guidelines, and policies that minimize unintentional mortality of bull trout in the Saint Mary and Belly rivers, and their tributaries.

3.2.2 **Evaluate enforcement of angling regulations and evaluate/review scientific research**. Ensure compliance with angling regulations and scientific collection policies. Target bull trout spawning and staging areas for enforcement, especially in the mainstem Belly River and Saint Mary River.

3.2.3 **Implement angler education efforts**. Continue to provide information to anglers about bull trout identification, special regulations, and how to reduce hooking mortality of bull trout caught incidentally in the Saint Mary River and Belly River watersheds.

3.2.4 **Solicit information from commercial fishermen**. Develop a reporting system to collect information on bull trout caught and killed or released by commercial fishermen on Saint Mary Lake. Take corrective action if warranted.

3.2.5 **Develop alternative method of commercial lake whitefish capture**. Research potential use of live traps to capture commercial whitefish and convert existing gill net fishery to that or other method(s) resulting in reduced take of bull trout.

3.2.6 **Coordinate with Alberta**. Continue close communication with Alberta Sustainable Resource Development to carefully monitor the potential effects of any legal bull trout fishery in Alberta waters.

3.3 Evaluate potential effects of introduced fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.

3.3.1 **Evaluate site-specific conflicts with introduced sport fish**. Determine site-specific levels of predation and competition of bull trout with introduced sport fish and assess effects of those interactions; especially brown trout and brook trout in portions of the Belly River drainage of Alberta.

3.4 Evaluate effects of existing and proposed sport fishing regulations on bull trout.

3.4.1 **Evaluate opportunities for regulated bull trout fisheries**. Evaluate any management proposals to allow carefully regulated harvest of bull trout where monitoring of the population status provides a clear record that a harvestable surplus can be maintained, and that harvest will benefit, or at least not be detrimental to, recovery goals. Though this task does not directly promote recovery of bull trout, increased public support for bull trout may indirectly benefit the fish.

3.4.2 **Increase harvest of competing species**. Adjust regulations in bull trout waters to encourage angler harvest of nonnative brook trout and other nonnative species. Examine potential to increase harvest of competing native species (lake trout, northern pike), in a manner that is compatible with bull trout persistence.

4 Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.

4.1 Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.

4.1.1 **Conduct genetic inventory**. Continue coordinated genetic inventory throughout recovery unit to contribute to establishing a program to understand the genetic baseline and monitor genetic changes throughout the range of bull trout (see Chapter 1 narrative).

4.2 Maintain existing opportunities for gene flow among bull trout populations.

4.2.1 **Maintain connectivity with Alberta**. Emphasize the importance of connectivity of the Alberta populations and important factors related to maintaining that connectivity across the international border.

*4.3 Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.*

5 Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site specific recovery tasks.

5.1 Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.

5.1.1 **Institute annual redd counts in index reaches**. Annual redd counts should be continued in Boulder and Kennedy creeks, and instituted in Lee Creek, and the North Fork Belly River in order to establish long-term trend information.

5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.

5.2.1 **Delineate important migratory habitat**. Further determine movement and seasonality of use of different habitat types by adult and subadult migratory bull trout with emphasis on the mainstem Saint Mary and Belly rivers (especially United States portions) and Lee Creek in Alberta.

5.2.2 **Evaluate effects of entrainment losses on population status**. Collect additional information on the population dynamics of Saint Mary River and Belly River bull trout local populations, related to assessing the impact of losses downstream into and over the Saint Mary Canal and United Irrigation District, Mountain View Irrigation District and Belly to Saint Mary canal diversions. A 2-year study of entrainment losses in Saint Mary Canal is beginning in 2002.

5.2.3 **Assess Saint Mary Reservoir**. Assess the suitability of habitat in Saint Mary Reservoir (constructed in 1946) and current use by bull trout. Evaluate impacts of that dam (and reservoir) on the connectivity of bull trout in the lower Saint Mary River and Lee Creek. Determine potential gains, if any, from restoring connectivity by passage over Saint Mary Dam.

5.2.4 **Evaluate temperature as a limiting factor**. Evaluate the potential role of seasonally elevated water temperatures as a limiting factor to juvenile bull trout rearing and/or adult migration in Swiftcurrent Creek, the Saint Mary River downstream from the Swiftcurrent Creek confluence and the Saint Mary Canal, and the lower Belly River drainage in Alberta.

5.2.5 **Identify suitable unoccupied habitat**. Identify suitable unoccupied habitat, if any. Within five years complete a comprehensive list of all known passage barriers blocking access to suitable habitat by upstream migrating bull trout in the United States and Canada.

5.2.6 **Evaluate species interaction with native lake trout and northern pike**. Examine the species interaction and/or habitat partitioning that has allowed bull trout to persist in the Saint Mary watershed alongside native populations of lake trout and northern pike, with possible implications to other areas where these other species have been introduced.

5.3 Conduct evaluations of the adequacy and effectiveness of current and past best management practices in maintaining or achieving habitat conditions conducive to bull trout recovery.

5.3.1 **Evaluate juvenile habitat in unstable systems**. Evaluate habitat conditions necessary to provide for highest quality juvenile rearing in naturally unstable watersheds like Boulder Creek and Divide Creek.

5.3.2 **Mitigate impacts of oil and gas exploration**. Based on past experience in the Belly and Waterton river watersheds of Alberta, develop best management practices to mitigate cumulative impacts of oil and gas exploration. These include, but are not limited to direct impacts on habitat and consequences to water quality and

quantity, as well as associated human impacts from opening up access for other types of development and increased angler use. Particular emphasis should be placed on Belly River watershed in Canada.

5.4 Evaluate effects of diseases and parasites on bull trout, and develop and implement strategies to minimize negative effects.

5.4.1 **Conduct wild fish health survey**. Conduct the National Wild Fish Health Survey throughout headwaters of the Saint Mary and Belly drainages to assess current status of fish pathogens, given the widespread legacy of past fish stocking and transplanting practices.

5.5 Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.

5.5.1 **Research historical distribution and abundance**. Collect additional information on the historical distribution and abundance of bull trout in the Saint Mary River and Belly River drainages to direct future recovery actions. Questions to answer include whether bull trout were historically present in Glenns Lake, or lakes upstream of Sherburne Dam.

5.5.2 **Finalize list of local populations and prioritize key watersheds for restoration actions**. Complete status and distribution surveys to a level sufficient to be used in refining site-specific lists of recovery tasks.

5.5.3 **Map spawning habitat**. Develop a comprehensive map of primary bull trout tributary spawning reaches for purposes of focusing habitat protection, law enforcement, and recovery efforts.

5.5.4 **Evaluate resident populations**. Evaluate hypothesis that some local populations may convert from migratory to "resident" status, due to the loss of functional connectivity. Assess fragmentation and isolation concerns as a result. Middle Otatso Creek and Lee Creek may provide one opportunity, although the migratory population in Lee Creek may be stronger than has currently been documented.

5.5.5 **Evaluate distribution, abundance, and habitat use by bull trout occupying the Saint Mary lakes**. A major research need is to develop information about the relatively unknown status, distribution, abundance and habitat preference of bull trout that occupy the large valley lakes in the basin; particularly since these fish are the only population in the United States known to have coexisted with native lake trout and northern pike.

5.6 Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.

5.6.1 **Conduct research on Cracker Lake Core Area**. Evaluate the isolated adfluvial bull trout population in Cracker Lake to determine likely origin of the population (native or introduced), potential core area status, important limiting factors, status of potential fish passage up Canyon Creek, and provide recovery recommendations, if needed.

5.6.2 **Evaluate Glenns and Cosley lakes**. Resurvey these waters to verify species composition and assess whether native bull trout exist or historically occurred above Gros Ventre Falls.

6 Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.

6.1 Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.

6.1.1 **Support watershed group restoration efforts**. Support collaborative efforts by local watershed groups to accomplish site-specific protection and restoration activities consistent with the Draft Bull Trout Recovery Plan (USFWS 2002).

6.1.2 **Protect habitat**. Provide long-term habitat protection through purchase, conservation easements, landowner incentives, management plans, etc. Current emphasis should be placed on important identified spawning and rearing habitat.

6.2 Use existing Federal authorities to conserve and restore bull trout.

6.2.1 **Coordinate all recovery actions with appropriate Alberta partners**. The province of Alberta has jurisdiction over most of the subadult and adult foraging, migrating, and overwintering habitat for bull trout in the Belly River, and to a lesser extent in the Saint Mary River. Coordination on land, water, and fisheries management activities between our two countries is critical.

6.3 Evaluate enforcement of existing Federal and Tribal habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.

6.3.1 **Encourage floodplain protection.** Encourage local governments to develop, implement, and promote restrictive floodplain regulations to mitigate extensive habitat loss and stream encroachment from rural residential and Glacier National Park development throughout the Saint Mary River and Belly River drainages. Development exacerbates temperature problems, increases nutrient loads, decreases bank stability, alters instream

and riparian habitat, and changes hydrologic response of affected watersheds.

7 Assess the implementation of bull trout recovery by recovery units, and revise recovery unit plans based on evaluations.

*7.1 Convene annual meetings of each recovery unit team to generate progress reports on implementation of the recovery plan for the U.S. Fish and Wildlife Service.*

*7.2 Develop and implement a standardized monitoring program to evaluate the effectiveness of recovery efforts (coordinate with 5.1).*

7.3 Revise strategy for recovery as suggested by new information.

7.3.1 **Periodically review progress towards recovery goals and assess recovery task priorities.** Annually review progress toward population and adult abundance criteria and recommend changes, as needed, to the Saint Mary - Belly River Recovery Unit Chapter. In addition, review tasks, task priorities, completed tasks, budget, time-frames, particular successes, and feasibility within the Saint Mary - Belly River Recovery Unit.